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Spring Element

Patent Claims

1. Spring element with a hydropneumatic strut to be positioned between the bogie and the body of a rail car, with the strut enclosing a sliding piston in a cylinder, whereby the piston or the cylinder can be connected with the bogie and the other component can be connected with the body, and the cylinder piston space is connected with a hydraulic accumulator, **characterized by the fact that** the hydropneumatic strut has a hydraulic height regulator valve or a height sensor connected or connectable with a feedback loop, by means of which the position of the piston in the cylinder can be adjusted or determined.

2. Spring element according to claim 1, characterized by the fact that the height regulator valve and the height sensor have a mechanical feedback loop that emits a signal, exclusively or also, in the strut adjustment area, which said signal is dependent on the position of the piston.

3. Spring element according to claim 2, characterized by the fact that the mechanical feedback loop emits, exclusively in the strut adjustment area, a signal dependent on the position of the piston, while the position of the mechanical feedback loop remains constant above and below the adjustment area.

4. Spring element according to one of the foregoing claims, characterized by the facts that the piston has a lug with at least some conical sections, and that the height regulator valve and the height sensor have a mechanical feedback loop that comes into contact with the surface of the lug at least in the conical area and undergoes a deflection dependent on the position of the lug.

5. Spring element according to one of the foregoing claims, characterized by the facts that a bore extending in the longitudinal direction of the cylinder is positioned in the cylinder head, and that the mechanical feedback loop of the height regulator valve or the height sensor is located in a bore extending perpendicular thereto in the cylinder head.

6. Spring element according to one of the foregoing claims, characterized by the facts that an auxiliary spring is integrated into the strut in such manner that the auxiliary spring does not increase the length of the strut.

7. Spring element according to claim 6, characterized by the facts that the auxiliary spring and the strut are arranged concentrically and that the auxiliary spring encloses the strut cylinder.

8. Spring element according to one of claims 6 or 7, characterized by the fact that the auxiliary spring is preloaded.

9. Spring element according to claim 8, characterized by the fact that the auxiliary spring is preloaded by means of a mechanical end stop or a hydraulic cylinder.

10. Spring element according to claim 9, characterized by the fact that the hydraulic cylinder is connected with the strut cylinder piston space.

11. Spring element according to one of the foregoing claims, characterized by the presence, for the purpose of wheel wear equalization, of an adjustment unit, aligned with the strut, that can be height-adjusted in the direction of movement of the strut and which is supported on the strut piston or strut cylinder.

12. Spring element according to claim 11, characterized by the fact that the adjustment unit includes a piston introduced into a hydraulic cylinder, height-adjustable in the direction of movement of the strut, and supported on the strut piston or strut cylinder.

13. Spring element according to claim 12, characterized by the presence of an equalizer pendulum one end of which is connected with the strut piston and the other end of which is connected with the hydraulic cylinder piston, the ends of the equalizer pendulum being spherical, to facilitate a movement of the strut crossways to the direction of movement of the piston.

14. Spring element with a hydropneumatic strut to be positioned between the bogie and the body of a rail car, the strut having a sliding piston in a cylinder, whereby the piston or the cylinder can be connected with the bogie and the other component can be connected with the body, and the piston area of the cylinder is connected with a hydraulic accumulator, characterized by the presence of an adjustment unit, aligned with the strut, that can be height-adjusted in the direction of movement of the strut and which is supported on the strut piston or the strut cylinder.

15. Spring element according to claim 14, characterized by the fact that the spring element is designed according to claim 1 and/or according to the characterizing portion of one of claims 2 to 13.

16. Spring element with a hydropneumatic strut to be positioned between the bogie and the body of a rail car, with the strut having a sliding piston in a cylinder, whereby the piston or the cylinder can be connected with the bogie and the other component can be connected with the body, and the cylinder piston area is connected with a hydraulic accumulator, characterized by the presence of another spring element that is aligned with the strut and which engages independent of the position of the strut piston.

17. Spring element according to claim 16, characterized by the fact that the additional spring element is designed as a coil spring or a rubber spring.

18. Spring element according to claim 16 or 17, characterized by the presence of an end-stop element designed to travel longitudinally in the direction of movement of the piston in the cylinder and by means of which the end position of the piston in the cylinder can be changed.

19. Spring element according to claim 18, characterized by the fact that the end-stop element is located in the piston end that faces the piston space.

20. Spring element according to claim 19, characterized by the presence of an additional piston space that is connected with the end-stop-element end that faces away from the cylinder piston space and which contains or can contain a pressure liquid.

21. Spring element according to one of claims 16 to 20, characterized by the fact that the end-stop element fit at least partially into a recess in the strut piston.

22. Spring element according to claim 20 or 21, characterized by the fact that if the hydraulic pressure of the strut drops, the additional piston space can be connected with a hydraulic accumulator containing hydraulic fluid.

23. Spring element according to claim 22, characterized by the fact that the accumulator contains a compressible gas.

24. Spring element according to claim 22 or 23, characterized by the presence of pressure-controlled valves that connect the hydraulic accumulator with the additional piston space if the hydraulic pressure of the strut falls below a pre-determined value.

25. Spring element with a hydropneumatic strut to be positioned between the bogie and the body of a rail car, with the strut having a sliding piston in a cylinder, whereby the piston or the cylinder can be connected with the bogie and the other structural component can be connected with the body, and the piston area of the cylinder is connected with a hydraulic accumulator, characterized by the presence of an end-stop element that is designed to slide longitudinally in the direction of movement of the piston and by means of which the end position of the piston in the cylinder can be changed.

26. Spring element according to claim 25, characterized by the fact that the spring element is designed according to claim 16 and/or according to one of the characteristic parts of claims 17 to 24.